THE report of the Magnetical and Meteorological Observations made at the Government Observatory, Bombay, for the year 1897 has just been issued, with an appendix.

MESSRS. ISENTHAL, POTZLER, AND CO., of Mortimer Street, have sent us a supplementary list of new radiographic instruments made by them. Attention is drawn to several pieces of apparatus of recent construction.

WE have received the prospectus of the "One and All" Flower-show, an exhibition of horticultural photographs, to be held at the Crystal Palace on August 14–19, under the auspices of the "Agricultural and Horticultural Association, Limited."

IN the number of the *Biologisches Centralblatt* for July 1, Dr. R. Keller finishes his review of recent advances in vegetable physiology and botany; and Dr. G. Lindner his account of the germs of Protozoa found in rain water.

THE *Cambridge University Reporter* for June 22 contains the annual report of the Botanic Garden Syndicate for the year 1898. Several interesting and important additions have been made to the Botanic Garden during the year.

IN the numbers of the *Agricultural Gazette of New South Wales* for May and June is a continuation of M. A. O'Callaghan's series of papers on dairy bacteriology. It contains a report, with illustrations, of the bacteriological condition of a number of butters produced in the Colony.

THE Trinidad *Bulletin of Miscellaneous Information* (Botanical Department, No. 19) contains a preliminary report by Mr. G. Massee on the cacao pod disease, which is rife in the Colony. Mr. Massee ascribes it to a fungus belonging to the Peronosporeæ.

IN the *Irish Naturalist* for July is a synopsis of the Irish Characeæ, by Prof. T. Johnson; a paper on some algæ from the Antrim coast, by H. Hanna; and one on some freshwater mites from Co. Dublin, by D. Freeman.

THE *Transactions* of the Manchester Microscopical Society contains several papers which show a record of good work in microscopy:—The genitalia and radulæ of the British Hyalinia, by W. Moss; *Peripatus Leuckarti*, by F. Paulden; Scale insects, by A. T. Gillanders; *Myriothela Phrygia*, a tubularian hydroid, by W. Blackburn; and others.

WE have received a copy of Dr. Gunnar Andersson's "Studies of the Quaternary Flora of Finland" (*Bulletin de la Commission Géol. de Finlande, Helsingfors*, 1898). The work is accompanied by four excellent plates of fossil seeds, and it contains descriptions and sections of the peaty deposits from which they have been obtained.

THE current issue of the *Reliquary and Illustrated Archaeologist* contains many interesting contributions, among which may be mentioned "Antiquities of Bolsterstone and Neighbourhood," "The Instrument of the Rosary," "Two Midlothian Souterrains," "The Grinlow Barrow, Buxton," and "Notes on Archæology and Kindred Subjects." As is usual in this magazine the articles are well illustrated.

MR. ARTHUR S. EAKLE describes some andesites from the Fiji Islands (*Proc. Amer. Acad. Arts and Sciences*, May 1899). Augite-andesite seems to be the predominating rock of the islands, and it varies from types having a small amount of augite with a large amount of felspar, and with biotite as an accessory, to those in which augite is the dominant constituent, thus showing a gradation into basalt.

VOL. II., part 6, of the serial form of C. E. Groves's translation of Fresenius' "Quantitative Analysis" has now been brought out by Messrs. J. and A. Churchill; the University Correspondence College has issued its Matriculation Directory dated June 1899, in which will be found articles on the special subjects for January and June 1900; a new edition of "The Arithmetic of Electrical Measurements," by W. R. P. Hobbs, has been issued by Murby. The work has been revised and in part re-written.

THE additions to the Zoological Society's Gardens during the past week include an Anubis Baboon (*Cynocephalus anubis*, ♀) from Accra, presented by Mr. G. B. Haddon Smith; a Feline Dourocouli (*Nyctipithecus vociferans*) from Brazil, presented by Mrs. Arthur Harter; a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by Mrs. T. Butt Miller; a Spotted Ichneumon (*Herpestes auro-punctatus*) from Malacca, presented by Mr. Geo. F. Aress; a Levaillant's Cynictis (*Cynictis penicillata*), two Bristly Ground Squirrels (*Xerus setosus*) from South Africa, presented by Mr. J. E. Matcham; a Common Duiker (*Cephalophus grimmi*, ♂) from South Africa, presented by Captain G. C. Denton; two Cormorants (*Phalacrocorax carbo*) from Scotland, presented by Mr. P. L. Pemberton; a Ground Hornbill (*Bucorvus abyssinicus*) from West Africa, presented by Mr. Geo. Hirst; two Blood-rumped Parrakeets (*Psephotus haematonotus*) from Australia, presented by Mrs. A. Chambers; a Golden Eagle (*Aquila chrysaëtus*) from Scotland, presented by Mr. H. C. Ross; three Adorned Terrapins (*Chrysemys ornata*) from Mexico, presented by Mr. C. J. Rickards; a Burchell's Zebra (*Equus burchelli*, ♀) from South Africa, two Hairy Armadillos (*Dasypus villosus*) from La Plata, a Lion Marmoset (*Midas rosalia*) from South-east Brazil, a Blue-fronted Amazon (*Chrysotis aestiva*) from South America, deposited; a Chattering Lory (*Lorius garrulus*) from Moluccas, purchased; two Collared Fruit Bats (*Cynonycteris collaris*), a Burrhel Wild Sheep (*Ovis burrhel*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN AUGUST:—

August 2. 11h. 25m. Minimum of Algol (β Persei).
11. Maximum of the August meteoric shower of Perseids.
14. 8h. 25m. to 9h. 37m. Occultation of the star D.M. − 22°, 3989 (mag. 6) by the moon.
14. 9h. 4m. Transit (immersion) of Jupiter's Sat. III.
15. Illuminated portion of the disc of Venus 0·989, of Mars 0·949.
18. 10h. 28m. to 11h. 34m. Occultation of f Sagittarii (mag. 5·1) by the moon.
22. 9h. 21m. to 10h. 15m. Occultation of 16 Piscium (mag. 5·6) by the moon.
22. 15h. 1m. to 16h. 8m. Occultation of 19 Piscium (mag. 5·2) by the moon.
23. Outer minor axis of Saturn's outer ring = 17″·94.
25. 9h. 57m. Minimum of Algol (β Persei).
26. 12h. 5m. to 13h. 5m. Occultation of τ^2 Arietis (mag. 5·2) by the moon.
26. 12h. 55m. to 13h. 51m. Occultation of 65 Arietis (mag. 5·6) by the moon.
27. 16h. 20m. to 17h. 19m. Occultation of v^1 Tauri (mag. 4·6) by the moon.
27. 16h. 49m. to 18h. 9m. Occultation of v^2 Taur (mag. 5·5) by the moon.
29. 16h. 9m. to 17h. 25m. Occultation of η Geminorum (mag. variable) by the moon.
30. 14h. 59m. to 15h. 58m. Occultation of ζ Geminorum (mag. variable) by the moon.

TEMPEL'S COMET 1899 *c* (1873 II.).

Ephemeris for 12h. Paris Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″	Br.
July 27	20 47 55·4	−21 56 9	3·698
28	49 6·7	22 29 17	
29	50 18·0	23 2 17	
30	51 29·2	23 35 4	
31	52 40·5	24 7 36	3·673
Aug. 1	53 51·8	24 39 49	
2	55 3·2	25 11 40	
3	20 56 14·6	−25 43 7	

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The comet is now as bright as it is expected to become according to computation, and moreover is rapidly moving southwards, so that it will soon be beyond the reach of observers in these latitudes. During the week it passes from a position near the 6th mag. star 17 Capricorni to the vicinity of the 4th mag. red star A Capricorni.

STELLAR AND NEBULAR SPECTRA WITH CONCAVE GRATING.—In the earlier part of 1898 Messrs. Poor and Mitchell described the results of their attempts to photograph stellar spectra with a Rowland concave grating (*Astro-Physical Journal*, 8, p. 157). The grating used was a small one, having a ruled surface of only 1×2 inches with 15,000 lines to the inch, the radius of curvature being about 1 metre. Later a special grating was made with a ruled surface $2 \times 5\frac{3}{4}$ inches, having 7219 lines to the inch. The radius of curvature of this was also 1 metre. The instrument was mounted on the 9·3-inch Hasting's refractor as guiding telescope, and the results obtained were very promising, although the observatory is on the *sixth* floor of the Physical Laboratory at Baltimore. In November 1898, however, by the kindness of Prof. Hale, it became possible for Mr. Mitchell to mount the grating on the 12-inch Brashear refractor of the Yerkes Observatory (*Astro-Physical Journal*, x. pp. 29–39, 1899). It will be remembered that the grating is used "*direct*," the concave surface bringing the diffracted beam from the star to focus on the plate, and that a considerable advantage obtains in that the spectra obtained are *normal*. The grating was so oriented that the lines were parallel to the equator, so that irregularities in the driving-clock should have no effect on the definition. The astigmatism alone not being sufficient to give the spectrum sufficient width, this was effected by allowing the star to trail in right ascension. Photographs of the spectra of a large number of stars have been thus obtained, with exposures varying from 5 to 60 minutes. These are given in a table in the article. Of special interest is the fact that these photographs show the ultra-violet region remarkably well, as is to be understood when it is remembered that the light has to traverse neither lenses, prism trains nor slit. The photograph of Sirius showed about 75 lines between $H\beta$ and $H\gamma$, and in the ultra-violet 21 lines of the series due to hydrogen were measured.

In February two very interesting photographs of the spectrum of the Orion nebula were obtained with exposures of about 200 minutes. Just as with an objective prism, these spectra consist of a series of images of the nebula, the measures of corresponding regions of which give the wave-lengths of the various lines they represent.

With the grating used, the length of the photographic region in the first order was about $1\frac{1}{4}$ inches, using Seed's gilt edge plates. In the second order the distance from $H\beta$ to $H\gamma$ was 0·6 inch, and from $H\beta$ in the first order to $H\beta$ in the second was 2·8 inches. The photographic plate used, 1×5 inches, thus included both spectra, and their duplicate measurement afforded a definite control over the wave-lengths determined.

Attention is directed to the fact that the spectra being *normal*, absolute measurements of wave-length, and therefore of motion in line of sight, may be determined when larger instruments of this kind are available. A grating with ruled surface 10×15 inches would probably be fully equal in performance to any spectroscopes in present use.

THE REASON FOR THE HISSING OF THE ELECTRIC ARC.[1]

II.

AND now we come to the most important of all the changes that take place when the arc begins to hiss, viz. the alteration in the shape of the *positive* carbon.

During the course of his 1889 experiments, Luggin (*Wien Sitzungsberichte*, 1889, vol. xcviii. p. 1192) observed that the arc hissed when the crater filled the whole of the end of the positive carbon. He was thus the first to call attention to the fact that there was a direct connection between hissing and the relation between the area of the crater and the cross-section of the tip of the positive carbon. My own observations in 1893 led to a conclusion somewhat similar to Luggin's, but yet differing in an important particular. It seemed to me that, with hissing arcs, the crater always *more* than covered the end of the positive carbon—that it overflowed, as it were, along the side. How far this is true will be seen from an examination of Figs. 4, 5, 6 and 7, which show the shaping of the carbons under various conditions with silent and hissing arcs. These figures have all been made from tracings of the images of actual normal arcs, burning between carbons of various sizes, and they were carefully chosen with special reference to the shaping of the positive carbons. For, with normal arcs, the shape of the end of a positive carbon, even taken quite apart from that of the negative carbon and of the vaporous arc itself, is capable of revealing almost the whole of the conditions under which the arc was burning when it was formed. It is possible, for instance, with a normal arc, to tell, from a mere drawing of the outline of the positive carbon and of its crater, whether the arc with which it was formed had been open or enclosed, short or long, silent or hissing, burning with a large or with a small current for the size of the carbon.

Take, for example, Fig. 4 (see p. 285, July 20), and note the difference in the shape of the positive carbon with a current of 3·5 amperes, as in (*a*), and with one of 34 amperes, as in (*b*). In the first case the tip of the positive carbon is rounded, so that the crater lies in its smallest cross-section; in the second, the tip would be practically cylindrical for some distance, but that the

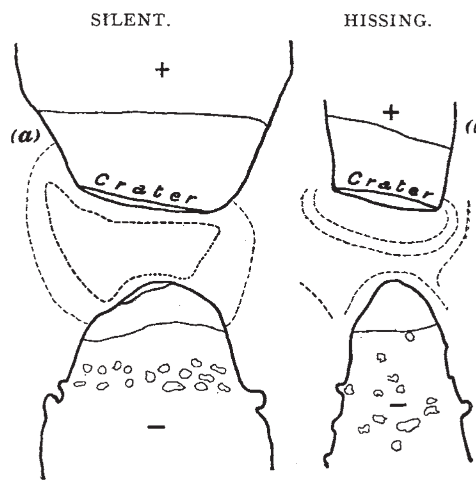

FIG. 7.—Carbons:—(*a*) Positive, 18 mm. Cored. Negative, 15 mm. Solid. (*b*) Positive, 9 mm. Cored. Negative, 8 mm. Solid. Length of Arc, 5 mm. Current, 25 amperes.

crater has burnt away a part of the cylinder, making the tip look as if it had been sheared off obliquely. Comparing now the tips of the positive carbons when the arc is silent and when it is hissing in all the four figures, 4, 5, 6, 7, we find the same difference. With all the silent arcs the tip is more or less rounded, and the crater lies in its smallest cross-section, and consequently is less in area than any but the smallest cross-section. With all the hissing arcs, on the other hand, the tip of the positive carbon is practically cylindrical for a short distance at least, or would be but that it is sheared away by the crater; consequently the area of the crater is *greater* than the smallest cross-section of the tip, or, indeed, than the cross-section of the tip for some little distance along its length.

We have now arrived at the real, the *crucial*, distinction between a silent and a hissing arc. When the crater occupies the *end* of the positive carbon only, the arc is *silent*; when it not only covers the end, but also extends up the *side*, the arc *hisses*. Hence, the arc must be at the *hissing point* when the smallest increase in the area of the crater will make it begin to cover the *side* of the positive carbon, and this can only be when the tip of that carbon has very nearly the same cross-section for some little distance from its end—in other words, when its sides are nearly vertical.

I shall now proceed to show that the extension of the crater up the side of the positive carbon is not the *effect* but the *cause* of hissing; that, in fact, *hissing is produced by the crater be-*

[1] Based on a paper read before the Institution of Electrical Engineers by Mrs. W. E. Ayrton. (Continued from page 286.)

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